Nudging Private Investors In The Real Estate Market

The use of psychological biases to reduce market bubbles

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Academic year 2017/2018

In order to obtain the Joint Degree
Master 120 en Sciences économiques, Orientation générale, Finalité spécialisée (UCL/UNamur)

And

Dottore magistrale in Economics and Political Science (UNIMI)

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Acknowledgments

I would like to thank all the people that somehow contributed to the work described in this thesis and that made possible the achievement of my Master degree.

Firstly, I would like to express my sincere gratitude to my Supervisor Johannes Johnen, Professor at the University of Louvain, for the help and the support throughout the learning process of the thesis.

My grateful thanks are also extended to my Reader Francesco Guala, Professor at the University of Milan, for his availability to fulfill the obligation of this role and for the interest that he demonstrated. I especially thank him for traveling to Louvain-La-Neuve to participate in person to the thesis defense.

Furthermore, I would like to deeply thank Tommaso for supporting me and encouraging me during this academic year, for always pushing me to do my best, and for always being there for me no matter what. I could have never done it without you.

Moreover, I would like to thank my family for having supported me during my whole academic path, for always encouraging me and believing in me, and for always being there to help me.

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Abstract

It has largely been agreed that speculative financial bubbles are mainly caused by psychological factors. That is why in this work I propose two nudges that exploit social comparison and the psychology of availability as a possible solution to decrease the probability of creation and propagation of speculative bubbles in the real estate market. The aim of these nudges is to target private investors in order to disincentivize them from investing in markets that are at bubble risk thereby reducing the volume of capital flowing into them.

1. Introduction

1.1 Brief overview of financial bubbles

Speculative financial bubbles have a long history in markets, from the tulip bubble in the Netherlands during the mid of the 1630s, the South See bubble in the early 18th century, the dot com bubble in the 1990s, the stock market crash of the 1929, the one of 1987, to the 2007 housing bubble and the current Bitcoin bubble suspect, just to name a few. Speculative bubbles happen when the price of a product extremely inflate beyond its real value. More specifically, as Shiller (2000) describes them, speculative bubbles are situations in which news of price increase boost investors' enthusiasm, which spreads from person to person by psychological contagion. During this process, this phenomenon of investor enthusiasm amplifies stories that might justify such price increase. This process involves more and more investors that, despite the doubts about the real value of the investment, decide to invest anyway partially because of a gambler excitement and partially because of the fear of missing out on an investment that everyone else is undertaking. Alan Greenspan, Chairman of the Federal Reserve Board from 1987 to 2006, used the term "irrational exuberance" to describe this risk taking and overconfident behavior of stock market investors during the dot com bubble. The consequences of speculative bubble burst are financial crises and severe damages to the economy. There are mainly three devastating common characteristics in the aftermath of financial crisis according to Reinhart and Rogoff (2009).

- First, market collapses are deep and persist for several years. Decrease in real housing prices averages 35% during the down phase of the cycle that lasts on average six years.
- Second, financial crisis that touch the banking system are associated with deep declines in employment and output. Output falls more than 9% on average, while the unemployment rate rises on average by 7 percentage points during the down phase of the cycle which is on average more than four years.
- Third, the value of government debt tends to increase exponentially. Real government debt increases by an average of 86% after three years. The main

cause of this increase in debt is the enormous collapse in tax revenues that the government suffers during the severe and prolonged output contraction. Furthermore, many countries also suffer because they have to pay higher interests on their debt when the general level of international rates soars. This phenomenon, combined with a countercyclical fiscal policy, contributes to building up additional debt.

In general, financial crises can be quite devastating and costly for the world economy, hence it is critically important trying to contain the speculative psychological factor that causes them. Speculative financial bubbles are a phenomenon that seems to constantly repeat itself throughout history; they are usually caused by people that keep investing in overvalued markets despite often knowing that they are not purchasing assets at their fair values. This issue is either due to the fact the investors tend to neglect risks when the market is having a positive momentum or, even if they are partially aware of them, they tend to bet on the fact that prices will keep rising in the future and that they will know when it is the right time to exit the market. In order to address both the psychological bias of neglecting risks and the overconfidence one of being able to time the market, I thought about designing two nudges aimed to increase private investors' risk awareness in the real estate market.

1.2 Why focusing on the real estate market

The choice of acting on the real estate market has mainly two reasons.

The first is that there might be an ongoing issue. There is the possibility that many major worldwide cities are already in a real estate bubble or they will soon fall into one. In Europe, prices have been sharply increasing since the beginning of 2014. According to Eurostat, during the last four years, the house price index (HIP)[1] increased by 15 points and this value begins to be worrisome given the fact that right before the 2008 crisis, from 2005 to 2008, its increase was of 18 points.

Furthermore, according to a study conducted by UBS in 2017, the steady increase in income growth in some European cities and the extremely low borrowing rates improved the economic sentiment and pushed a robust demand for urban housing

[1] As defined by Eurostat it "measures the changes in the transaction prices of residential properties, both newly built and existing, purchased by households."

properties. Since supply is always constrained in the most desired cities, this resulted in soaring prices.

In North America, more specifically in Canada, the situation is similar. Cities such as Vancouver and Toronto have entered into the bubble risk territory according to the same UBS study (2017). In fact, neither cities suffered too much from either financial crisis or weakening commodity prices. On the contrary~~,~~ the depreciation of the Canadian dollar staunched them against economic headwinds. At the same time, they have been affected for too long by a loose monetary policy and lively foreign demand. This positive economic outlook led investors in moving capital to the Canadian housing market resulting in unmooring it from its economic fundamentals.

Similarly, the UBS report (2017) signals Hong Kong as having alike risks. In fact, due to an instable investor demand and speculative price expectations, house prices reached an all-time peak during 2017.

Secondly, interest rates (and therefore mortgage rates) have been exceptionally and persistently low since the 2008 crisis. According to several recent empirical studies, a prolonged period of low interest rates predicts negative economic outcomes and the risk of bubble creation. For example, Schularick and Taylor (2012) showed, using a sample of 14 developed countries between 1870 and 2008, that fast credit expansions predicts declines in real activity. Similarly, Mian, Sufi, and Verner (2015) showed that the increase of household debt forecasts slowdowns in the economy. On the same note, Jorda, Schularick, and Taylor (2013) explained how recessions tend to be worse when they come after credit-intensive expansions. Baron and Xiong (2014) found, using a sample of 20 developed countries, that bank credit expansion forecasts an increase in crash risk in both equity markets and bank stocks. Greenwood and Hanson (2013), in their study proved as well how the average quality of subjects borrowing money tend to be lower when the credit cycle is having a booming period (when much capital is available there is a higher possibility of undertaking risky loans).

Thus, nowadays, because of the persistently low interest and mortgage rates, there has been a particularly positive environment for investments. In other words, many years of low interest rates and cheap capital availability in all major economies have potentially set the ground for the development of recessions and real estate financial bubbles across the world. Therefore, it is an interesting and appropriate moment to act upon the real estate market in order to try to reduce the probability of speculative financial bubbles.

1.3 Thesis proposal

As introduced in the previous section, the costs of financial crisis caused by speculative financial bubbles are distressing for the world economy. Therefore, it is of fundamental importance to try to reduce the probability of the creation and propagation of speculative bubbles and, by doing that, to contain the related economic and financial damages caused by an eventual bubble burst.

A solution could be to reduce the volume of capital invested in these overvalued markets. In order to this, I designed two nudges that aim at reducing private investors' overconfidence and their bias of neglecting risk.

The first nudge that I designed exploits social comparison, a tendency that people have to evaluate themselves in comparison to others. The nudge would take the form of a digital questionnaire with ten questions about the financial and real estate markets through which investors will be able to test their financial skills and knowledge. Each question is worth one point and, after the questions are completed, the subject will receive its personal score compared to the median of all the other participants that answered that same questions. Thanks to the social comparison bias, I hope that the investors that will answer worse than the median will reconsider their financial skills and knowledge. Therefore, I expect that they will take more information and either decide to not invest or to invest less capital (or at least to gather more information regarding the real estate and financial markets so that they can invest more responsibly).

The second nudge that I designed exploits the psychology of availability, a phenomenon that affects peoples' impressions of the possibility of an event when they are asked to list a specified number of examples. Specifically, people are less confident in a choice when they are asked to provide many reasons to support it. Therefore, the nudge will take the form of a questionnaire where private investors will be asked either to list six reasons why their investment could be a risky one or to list twelve reasons why their investment is a sound one. I also will ask subjects to rate how good they think their investment is. I expect that it will be quite difficult for investors to enumerate twelve good reasons to invest, as usually it is easier to retrieve less reasons for every choice, and therefore that they will think that their investment is not as sound as they thought it was. On the other hand, I expect that it will be fairly easy to enumerate six reasons why an investment could be risky. In this way, I hope to obtain the same results of the previous nudge, and therefore reducing the capital flowing into these potentially risky markets.

In the next section I will present the main psychological and cultural factors that contribute to the creation of speculative financial bubbles. In section three I will present the abovementioned nudges in details, while in section four and five I will explain the nudge implementation and the experimental design respectively.

2. Factors of speculative financial bubbles

Before diving into potential solutions to reduce financial bubbles, it is fundamental to examine what are the main underlying causes that trigger them. There are several possible roots that can cause a speculative bubble: cultural factors, structural factors and psychological factors. In the following two section I will present the most relevant ones.

2.1 Structural and cultural factors

Finding the causes of over evaluated market is not easy nor straightforward. Most historical events do not have a simple cause but a confluence of factors that together set off extreme events. The same applies to speculative bubbles, in fact there are many structural factors behind them. For example, Shiller (2000) explained some precipitating factors that drove the last stages of the Millennium boom (1982-2000). The most important in this case is the arrival of the internet. Thanks to its vivid and immediate impression, it made more people believe that it also had a great economic importance. This happened because it was much easier to imagine the future advances in this technology than inventions in other fields since this was more commonly available to the public than others. This revolution, created strong public impressions that influenced the ease with which examples of the plausibility of the internet lore came to mind.

Another important factor was the expansion of the media reporting business news and the exponential increase in sections dedicated to investment talks and tips. This enhanced reporting of investment options led to an increase in demand for stocks.

Furthermore, because this was a period of cultural and political changes favoring business success accompanied by a significant increase in materialistic values, more people started to invest. In the United States, this was also leveraged by the election of a republican congress who was much more pro-business than their democratic predecessors and gave fiscal benefits to investors (for example, the capital gains tax rate was cut from 28% to 20% in 1997 and only the rumor that more capital gains cut were about to be made had a favorable impact on the market).

In addition, analysts' optimism was constantly rising in their forecasts and they almost never suggested to sell. This optimism was also encouraged by the fact that many of them were employed by companies that underwrote securities. In fact, because the suggestion to sell the stock of a certain firm may cause that firm to be unhappy, analysts feared to be excluded from future information sessions and to not been given any more access to key executives.

Another factor of the surge in the market was the public perception of the baby boom of 1946-1966. In fact, people believed that the unusually high number of individuals, now between the age of 35 and 55, ought to boost the stock market for two reasons: high price-earnings ratios were justified by boomers competing to buy stocks to save for their retirement and high spending on current goods and services boosts stock prices.

Another factor was the expansion of defined contribution pension plans. This change in the nature of pension plans incentivized more people to learn about, and eventually accept, private investments. Curiosity rather than fundamentals was the main driver that led investments in this period.

Furthermore, during that time, mutual funds increased exponentially their popularity and with them the idea that they were safe, sound and convenient. Therefore, many investors that were once scared of entering the market began to reconsider this as an option.

The declining costs of trading, due to the drop in commission rates and the significant growth of online trading services, played another critical role. It resulted in an increased volume of trade which led the turnover rate for the New York Stock Exchange to nearly double between the 1982 and 1999.

Finally, the rise of gambling opportunities, supported also by the government, promoted a risk taking behavior that translated also in a gambling behavior towards financial markets yielding to irrational investing.

As Shiller (2000) reminds us, many of these factors have a self-fulfilling aspect and it is almost impossible to quantify how much each of them contributed to the Millennium boom. Speculative bubbles precipitating factors change according to times and situations, but they all have two common elements. The first, is the overconfidence in the capability of timing the market. The second, is the neglecting of risks by wrongfully thinking that "this time is different from the past"[2] and that

[2] Reinhart and Rogoff (2009)

this time there really are fundamental reasons why the market's level is so high. As Reinhart and Rogoff (2009) explain, people have a tendency to believe that this time will be different because they think they are doing things better than before, having learnt from past mistakes, and because they are wrongfully confident that they will know about the crisis long enough before it happens. For example, this also occurred during the financial crisis of the American housing market. When in 2005 and 2006 U.S. home price growth outpaced the increase in gross domestic product, Alan Greenspan, former Federal Reserve Chairman, said that the economic situation was different. He justified the rising prices as a consequence of widespread securitization that made real estate more liquid. Ben Bernanke, Greenspan's successor, claimed as well that it was normal to have low saving rates at home and high saving rates abroad. People thought that it was normal for the United States to handle massive inflows of capital having the most sophisticate financial markets and being the largest economy in the world. Furthermore, they thought that the United States had the best policy maker and monetary policy institutions and that innovative financial instruments caused a new and solid demand for housing by allowing previously denied borrowers to take out mortgages. Therefore, also during this boom, where the signs of market overvaluation were evident and clear, people were affected by, as Reinhart and Rogoff (2009) defined it, the "this time is different" syndrome, strongly rooted in the belief that financial crisis happen at other times, in other countries and to other people.

According to Shiller (2000) another core factor of speculative bubbles is the feedback loop theory. It involves three main elements: a precipitating event that causes prices to increase, positive feedback trading, and social contagion that attracts new investors. When prices increase, investors tend to revise upward their demand for that asset. This leads to more price increases which loop into a negative spiral ending up in overvaluing the market. It is easy to see how the initial effect of the precipitating factors can exponentially be amplified. Barberis, Shleifer and Vishny (1998) claim that feedback theory relies on adaptive expectations: past price increases generate expectation of further price increases. Another version of this theory says that feedback happens because of an increase in investors' confidence due to past prices increases and Shiller (2000) argues that this is likely to occur not because of a sudden price increase but because of a consistent pattern in price increases. An alternative story for the feedback theory relies on psychological factors. He also explains that feedback theory can also take place for emotional reasons that are not connected with expectation nor confidence. In fact, it may happen that investors may feel like they are "playing with the house money". Thaler and Johnson (1990) explains that this phenomenon happens when investors' mind is framed by the fact that they have been in a booming market for a while and they feel that since they had some gains, they can afford to gamble that money. The same happens when gamblers win an unexpected sum of money and they keep playing because they are "playing with the house money" and even if they lose, to them, those are not their own money.

Shiller (2000) also argues that the public perception of a bubble might play a role. In fact, since the feedback loop theory it is so widely known, it might happen that some people recognize that a bubble may exist and they still decide to invest to take advantage of it for a while. With that being said, he argues that it still would be inaccurate to think that people have understood this process so clearly that they recognize exactly when it is happening and when it is time to exit it before it collapses. Cultural factors, like the news media, play an important role in the creation and propagation of speculative bubbles. In fact, the media, in order to keep a high number of followers, need news that have a high word-of-mouth potential. That is why they are so attracted to the real estate and stock market which supply them with many and important news.

According to Shiller (2000), the media also organize constant talk shows and debates about issues that experts would not even consider discussing on just to keep people interested. Furthermore, he argues that there is a reporting shortage of relevant facts and the considered interpretation of them. In this way, news seems to give the impression that new records are constantly being set. It seems that the role of news events does not affect the market right away and set in motion a "sequence of public attentions" (Shiller 2000). They are facts or stories that may already be well known by people, but that can gain newfound prominence in the wake of braking news. Shiller (2000) calls this phenomenon "attention cascade" as one focus of attention leads to attention to another, and another, and so on. An example that helps to better understand this phenomenon is the Japanese earthquake of 1995 and how the stock market reacted to it. This example is interesting because the event of the earthquake was completely exogenous and not generated by human activity. The earthquake was quite devastating, many victims were involved and the total damage estimated was around $100 billion. The reaction of the financial market was very curious, in fact the Tokyo stock market fell slightly that day, but the biggest reaction to the earthquake came only a week later. This was because the news kept showing scary images of the devastating accident for days and kept talking about the high risk of seismic activities around the Tokyo area. Despite the fact that it was already known for years that Tokyo was at seismic risk, greater attention was now focused on this potential issue and the stock market was affected.

Thanks to this examples it is easy to understand how the media are propagators of speculative price movements. Attaching news stories to price movements that are already well known to the public, they manage to increase the salience of price movements and catalyze more attention to them.

2.2 Psychological factors

In recent years, behavioral finance theory has been proposed as a tool to understand the phenomenon of financial bubbles. According to this theory, investors often do not update their beliefs correctly because they are subject to systematic biases. Furthermore, individuals make objectively wrong and nonsensical choices even though traditional finance theories advocate that this should not happen. "In a behavioralist context (though), given the psychology of human behavior, bubbles are a naturally occurring phenomenon"[3].

There are three main psychological phenomena that contribute to the creation of a financial bubble: anchoring, herd behavior and overconfidence[4].

In order to understand what determines the level of financial markets and stock fluctuations it is fundamental to turn to psychology and more specifically to quantitative and moral anchors. Quantitative anchors influence people's decisions in ambiguous situations. When people are asked to give a numerical estimation on

[3] Gray, W. (2016, May 31). Warren Buffett Helps Tackle The Age-Old Question: 'What Makes A Financial Bubble?. Retrieved from: Forbes website

[4] Shiller, Robert J. (2000) "Irrational exuberance". Princeton, N.J. Princeton University Press.

something they do not know, they will use whatever anchor (number) is available to them.

A famous and particularly interesting experiment carried out by psychologists Tversky and Kahneman (1974) demonstrated this bias: the subjects of the experiment were positioned in front of a wheel, similar to those used in television shows, designed to stop at a random number from 1 to 100 after being spun. So, participants were well aware that the wheel returned a random number. After the wheel stopped on a random number, subjects were asked a very difficult question to which they could not possibly know the answer (i.e. what is the percentage of African Nations in the United Nations). Then, they were asked to first say if their answer was a number above or below the one indicated by the wheel. Afterwards, they were asked to give their answer. It was shown that even if participants knew that the number indicated was completely random, their answers were substantially influenced by it. For example, if the wheel stopped on the number 10, the median percentage of African nations according to the subjects was 25, while if it stopped on 65 the median percentage was 45.

According to Shiller (2000), when investors evaluate the level of stock prices, the most likely anchor is the most recently remembered price. This tendency is one of the reasons of the similarity of stock prices from one day to the next. Consequently, investors are biased by the latest prices they can recall. In particular, this phenomenon leads to keep the momentum over the short run (i.e. positive increments in prices tend to be followed by other positive increases as well as negative ones tend to be followed by other decreasing ones). This tendency is reverted in the long period when investors see prices diverge from fundamentals and it may be a part of the reason for trends in individual prices to be subject of reversals.

Furthermore, Shiller (1989) explains that anchoring may be the reason why individual stock prices move together and consequently why stock prices indices are so volatile. In fact, for individual stocks, price changes may tend to be anchored to the price change of other stocks, and price-earnings ratios may be anchored to other firms' price-earnings ratios. Anchoring could also be an explanation of the fact that stock of companies that have headquarters in the same country but are in different industries tend to have more similar price movements than stock of companies that have headquarters in different countries but are in the same industry. This is contrary to the expectation that the industry would define the fundamentals of the company rather than where its headquarters are located[5].

In conclusion, as Shiller (2000) defines them, quantitative anchors provide for the appropriate levels of the market that some individuals use as indications of whether it is a good time to buy and if the market is over or under priced.

On the other hand, moral anchors as defined by Shiller (2000), "operates by determining the strength of the reason that compels people to buy stocks, a reason that they must weigh against their other uses for the wealth they already have (or could have) invested in the market. With moral anchoring, the market is tied down by people's comparison of the intuitive force of stories and reasons to hold their investments against the perceived need to consume the wealth that these investments represent". Behind the notion of moral anchors there is the psychological principle that much of human thinking that results in actions is not quantitative but takes the form of storytelling and justification.

This concept can be better explained through some examples. According to Shiller (2000), investors often respond more to stories about stocks and to impressive stories about the company or the nature of the product, rather than to quantitative evidence about earnings or future dividends. This psychological phenomenon is the same that affects gamblers. In fact, when gamblers are heard talking, they are usually telling stories about their wins and losses and the events that preceded their biggest wins, instead of talking about evaluating probabilities. These stories can give a sense of meaning to events that are totally random[6]. Another study by Benartzi, Thaler, Utkus, and Sunstein (2007), shows that employers of a company are more prone to buy many stocks of that company even if it would be in their best interest to diversify away from their main source of income. Shiller (2000) claims that this is due to the fact that employees know many vivid stories regarding their own company than stories of other companies. It seems that people want to construct simple reasons for their

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[5] Heston S. L. & Rouwenhorst K. G. (1994)"Does Industrial Structure Explain the Benefits of International Diversification?". Journal of Financial Economics, Vol. 36, pp. 3-27

[6] Keren, G. (1994). The rationality of gambling: Gamblers' conceptions of probability, chance and luck. In G. Wright & P. Ayton (Eds.), *Subjective probability* (pp. 485-499)

choices, as if they felt the need to justify to themselves these decisions in simple terms.

Another psychological factor that contributes to the creation of speculative bubbles is heard behavior. Heard behavior is a human tendency to follow the crowd, leading completely rational individuals to make decisions that they probably would have not taken if alone. This happens even if the they know that everyone else is behaving in a heard like manner. Following "the heard" people might often make decisions or do things that they actually think are wrong or that they disagree with. This is mostly due to social pressure, the need to conform and not being an outcast. When individuals are in a heard like situation they systematically think that if so many people are doing that same thing they cannot all be wrong and that maybe others know something that they do not.

For example, social psychologist Solomon Ash carried out an experiment in 1952 that exactly demonstrated this concept. This experiment was done at a time when there was widespread public concern with the effects of communist propaganda, alarmism due to the apparently successful brainwashing techniques of Chinese communists. In the experiment, he placed a subject in a group of nine people who were confederates coached by Ash and were unknown to the subject. Everyone was asked to answer twelve questions about the length of some drown line segments shown to them. The subject was usually one of the last to answer so that he could hear all the previous answers given by the coached participants. The answer to the questions were quite obvious, but the confederates deliberately answered wrong to seven of them. Faced with a group of people who were all giving what seemed to be the same obviously wrong answers, one third of the time the subject followed the crowd and gave as well the same wrong answers given by the confederates. Most of the subjects also shown signed of anxiety and distress during the experiment, suggesting that the fear of being the outcast or being seen as foolish before the group influenced their judgment. At the beginning it was thought that the outcome of this experiment was due to social pressure. However, the same experiment with some different characteristics was carried out by Deutsch and Gerard (1955). Individuals were told that they had been placed anonymously into a group and that they could see indirectly how the others answered through an electronic signal and they could answer merely by pressing a button without being seen. It was found that individuals behaved as the group because people are incline to think that if so many people are doing that same thing they cannot all be wrong and not because of social comparison.

Considering these experiments, it is easy to see how the same behavior can happen with matters like the stock or real estate market: investors fear that other investors have more information or know more than what they do. They think that if everyone is doing the same thing, like buying for example, then they cannot all be wrong. When there is a new investment fed, investors are put into pressure to follow the heard. They fear to look like fools for behaving differently and missing out on that opportunity in which everyone is investing. In fact, if the investment go well they will not look like fools, while if it does not go well everybody was doing it anyway and they will not be judged as outcast. This is why investors fall in faulty reasoning and behave like the heard[7].

Overconfidence is another bias from which individuals, and specifically investors, are affected and it is one of the most important psychological factors that contributes to the creation and propagation of speculative bubbles. In fact, people often think they know more than they actually do. For example, in a study conducted by Fischhoff, Slovic, and Lichtenstein (1977) it is shown that too often people are certain of their answer to a variety of general questions (i.e. which of two common causes of death is the most frequent, or which magazine had the largest circulation rate in the 1970s). On average, people that said to be certain about their answer were right only 80% of the times. Individuals tend to overestimate the probability that their answer is right.[8]

Overconfidence is a "robust human character trait" (Shiller 2000) and even though people can sometimes be trained to not be affected by overconfidence[9], there is definitely a bias towards over-confidence rather than under confidence (Shiller 2000). There are quite a few explanations of why individuals tend to be overconfident. One of them, is that individuals look for confirmation in their reasoning by looking for

[7] Shiller, Robert J. (2000) "Irrational exuberance". Princeton, N.J. Princeton University Press.

[8] Fischhoff, B., Slovic, P., Lichtenstein, S. (1977) "Knowing with Certainty: The Appropriateness of Extreme Confidence". Journal of Experimental Psychology: Human Perception and Performance 1977, Vol. 3, No. 4, 552-564

[9] Gigerenzer, G. (1991) "How to Make Cognitive Illusions Disappear: Beyond "Heuristics and Biases"". European Review of Social Psychology (Vol. 2, pp. 83–115)

similarities in other known situations and observations, forgetting that there are many more available situations with which they could compare[10].

Another explanation, is that people tend to evaluate the probability that they are right only at the last stage of their reasoning not considering all the other steps and other elements of the reasoning process that could be wrong[11].

A curious factor of overconfidence is the so called "magical thinking". With this term, psychologists refer to the phenomenon that occurs when investors feel that certain actions will bring them luck even if they know that rationally these actions will have no such effect on their fortunes. For example, it has been demonstrated that people will place larger bets on a coin that has not yet been tossed rather than on a coin that it has already been tossed. Similarly, if people were to be asked to sell a lottery ticket that they had bought, they would set a price at least four times higher if they themselves picked the lottery numbers on the ticket. Individuals will make important decisions based on thinking that they would themselves admit as irrational, like influence the outcome of a coin that has not yet been tossed or winning the lottery only because they picked the numbers[12].

Another aspect of overconfidence is representativeness heuristic, an anomaly in human judgment that leads individuals to make judgments and take decisions in uncertain situations by relying on known and familiar patterns that easily come to mind by assuming that future patterns will be similar to past ones.[13] This bias causes investors to be prone to believe that a history of a good performance of a given stock is representative of a general performance that the stock will continue to rise in the future.

According to Strahlberg and Maass (1998) hindsight bias, a tendency to feel that one already knew what was going to happen after an event occurs, may also play a role in overconfidence. This bias makes individuals perceive reality as more predictable than it really is, therefore fostering overconfidence and feelings of being able to "know-it-all". Shiller (2000) claims that these phenomena are likely the cause of faulty

[10] Collins, A. et al. (1975) "Reasoning from Incomplete Knowledge".
[11] Gordon W. Pritz, "Subjective Probability Distributions for Imperfectly Known Quantities" in Lee W. Gregg(ed.), "Knowledge and Cognition" (Potomac. Md.: Lawrence Erlbaum Associates, 1975), pp. 29 - 41
[12] Langer, E. J. (1975) "The Illusion of Control". Journal of Personality and Social Psychology, Vol. 32, No. 2, 311-328
[13] Tversky and Kahneman, "Judgment Under Uncertainty: Heuristics and Biases". Science, 185: 1124-1131.

reasoning of investors. In fact, based on the previous examples, it is likely that investors could incur in the following reasoning: "If I buy a stock, then it will go up afterwards" or "I have a hot hand lately, luck is with me" or "If I bought this stock other people will as well because they are like me". This kind of reasoning, according to Shiller (2000) is likely to contribute to over-confidence, that may consequently help financial bubbles propagation.

Without overconfidence, if people were completely rational, at least half of the investors would consider their trading ability below the average and therefore would decide to abstain from speculative trading. Therefore, according to Milgrom and Stokey (1982), there would be little trading in financial markets and unlikely possibility of speculative bubble creation. Furthermore, overconfidence can influence individuals to believe that they know when a market move will happen even if according to the efficient markets hypothesis in the classical financial theory, asset prices are not forecastable. Shiller conducted a survey with investors right after the crush of October 19, 1987 and asked the following question "*Did you think at any point on October 19, 1987 that you had a pretty good idea that a rebound was about to happen?*". Of individual investors 47.1% of who had bought on that day answered yes and 47.9% of institutional investors said yes. Furthermore, 29.2% of investors who did not buy nor sell answered yes to the question. According to Shiller (2000) this stands in contrast to the most elementary observations of markets' forecastability and contrary to the knowledge that right market timing is very difficult. On the same questionnaire Shiller asked also the following question: "*If yes, what made you think you knew that a rebound would occur?*" There was a striking absence of quantitative or empirical explanation, no mentions to concrete facts or evidence and most of participants' answers were "intuition", "gut feeling" and "historical evidence and common sense". As demonstrated by these examples, overconfidence in people's judgment plays a fundamental role in the creation of speculative bubbles.

3.Nudges

In this section, I will first explain what is a nudge providing some examples, then I will present and explain the two nudges that I designed in order to reduce the effects of financial bubbles in the real estate market. These nudges aim at reducing investors' overconfidence and their bias towards neglecting risk, that are some of the main psychological factors that cause the creation and spread of speculative financial bubbles.

3.1 Nudge definition and basic concepts

Tahler and Sunstein (2008) define a nudge as a change in the choice environment that affects people's behavior in a predictable way without changing significantly the incentives. They use a very effective examples to demonstrate this concept: a canteen manager randomly chose a population of canteens where she changed the disposition of healthy food. She positioned healthy food in a more reachable way and applied better lighting to them than less healthy foods. The sales of salad, fruits and other healthy meals increased by up to 25% in the canteens where this nudge was applied. Another example of a nudge is to enroll by default newly employed in the 401(k) plan. In a study conducted by Madrian and Shea (2001) it was demonstrated that participation to the 401(k) is significantly higher under the default option of automatic enrollment. In fact, in the Unites States people needed to actively sign up for the 401(k) but many people did not do it because humans are inclined to inertia.

Thanks to these two examples, it is easy to understand how nudges work: they change the choice environment without changing the incentives and this is enough to alter the behavior of people and the choices they make. This phenomenon goes against the principles of a classical economic agent who would have behaved in the same way and would not have been affected by the abovementioned nudges. In fact, according to the Expected Utility Maximization theory, when presented with various alternatives the self-interested and completely rational homo oeconomicus will choose the option that maximizes his/her individual utility. The homo oeconomicus has preferences that are purely instrumental and selfish, that do not depend on his/her psychological state and that are exogenous and stable. The homo oeconomicus discounts future utility exponentially in dynamic settings and when facing risk, he/she will choose the alternative that will maximize his/her utility. Most of the times though, humans do not behave as the homo oeconomicus and deviate from Expected Utility Maximization theory. This happens mainly because people are affected by cognitive biases, which are systematic mistakes that individuals make when reasoning, remembering or evaluating something[14].

Nudges are a powerful instrument that can be used to change the choice environment in order to address people towards the best choice from a welfare point of view. This is done without changing the incentives and therefore without imposing one alternative on people.

3.2 First nudge: exploiting social comparison

The first nudge that I designed exploits the effect of social comparison. This phenomenon was initially explained by the socio psychologist Leon Festinger in 1954. The theory explains that people evaluate their own beliefs and abilities by comparing themselves to others in order to diminish uncertainty in these domains, and learn how to define themselves. Therefore, especially in modern society where there are many implicit norms and rules, descriptive norms can influence people's behavior. Furthermore, increasing the attention to a descriptive norm strengthens its influence on people's behavior.[15]

Social comparison has been used in the nudge literature in order to provide individuals with information about the behavior of relevant peers in order to increase charitable giving[16] and to decrease households' energy consumption[17]. For instance, in the latter case, in order to reduce households' energy consumption in the United States, a report called Home Energy Report was included with the energy bill received

[14] Mathis, K. and Steffen, A. D. (2015). From Rational Choice to Behavioral Economics Theoretical Foundations, Empirical Findings and Legal Implications. In European Perspective On Behavioral Law and Economics, ed. Klaus Mathis, 31-48. Cham/Heidelberg/New York/Dordrecht/London: Springer

[15] Cialdini, R. B., and Reno R. R., Kallgren , C.A., (1990) "A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places". Journal of Personality and Social Psychology 1990, Vol. 58, No. 6,1015-1026.
Bohner, G., Moskowitz, G.B., Chaiken, S. (1995) "The Interplay of Heuristic and Systematic Processing of Social Information". European Review of Social Psychology, 6:1, 33-68.
Harvey, M. D., & Enzle, M. E. (1981). A cognitive model of social norms for understanding the transgression–helping effect. Journal of Personality and Social Psychology, 41(5), 866-875.

[16] Bartke, S., Friedl, A., Gelhaar, F., Reh, L. (2016) "Social Comparison Nudges: Guessing the Norm Increases Charitable Giving". Kiel Working Paper, No. 2058, Kiel Institute for the World Economy

[17] Alcot, H., Kessler, J. B. (2005) "The Welfare Effect of Nudges: A Case Study of Energy Use Social Comparison". National Bureau of Economic Research, working paper 21671.

by each homeowners. This report is a one-page letter that compares through a bar graph a household's energy use to that of its 100 geographically nearest neighbors in similar house sizes. The report also provides energy conservation tips. Consumers earn one smiley face for using less than their mean neighbor's usage and two smiley faces for using less than their "efficient neighbors'" consumption (20th percentile). Thanks to social comparison, energy consumption was significantly reduced because people started comparing their energy consumption with their neighbors' one, and this fostered self-improvement and self-motivation to do better.

Similarly, the nudge that I created aims at reducing investors' overconfidence through social comparison. The aim is to make investors realize that they are not necessarily better than others at making market evaluations and at gathering information. In order to accomplish that, I designed an anonymous digital survey with ten questions, each worth one point, about the financial and real estate market aiming at making investors test themselves on how much they are informed and educated about basic financial concepts. When the responses are submitted, the subject receives an immediate score indicating how many questions they answered correctly and the median result of other people that took that same test. For example: "*You answered 4/10 questions right. The median result scored of people taking this same test is 7/10*". If people get a score that underperforms the average, this might lead them to think that they do not know much about finance compared to other investors and they might reconsider how good their financial skills and knowledge are. Thus, they might start worrying that they are not such expert as they thought they were. Ideally, they would think to not have the financial skills to undertake the investment and more specifically they would start questioning their ability to understand when the bubble will burst. As a consequence, I expect that they will start to get more informed and decide not to invest or to invest less and more carefully. In this way, if less capital flows in markets where there is the suspect of a speculative bubble, its propagation will be lower and the costs associated with its eventual burst will be downsized.

In the next two pages it is shown the questionnaire designed to make investors test themselves on basic financial skills and knowledge. The test is divided in two main parts: the first five questions are about the financial market, while the last five are about the real estate market. The first five questions are provided for by the American Financial Industry Regulatory Authority (FINRA). FINRA is a non-profit, non-governmental organization authorized by the American Congress to protect American investors by assuring that the broker-dealer industry operates honestly and fairly.[18] They designed a survey with fifteen questions about basic financial concepts in order to understand how much American private investors actually know about investing. I selected five of these questions and included them in my survey for the part regarding financial markets. For questions 6 to 10, regarding the real estate market, question 8 to 10 were provided for by the Real Estate Financial Modelling (REFM). REFM is a consulting company that also offers learning tools and the possibility to get certifications for becoming real estate consultant.[19] Finally, I designed question 6 and question 7 taking examples from the samples provided by FINRA and REFM.

[18] https://www.finra.org/

[19] https://www.getrefm.com/

Please answer to the following questions. Each question is worth 1 point.

1. Which is the best definition of "selling short"?

- ☐ Selling shares of a stock shortly after buying it
- ☐ Selling shares of a stock before it has reached its peak
- ☐ Selling shares of a stock at a loss
- ☐ Selling borrowed shares of a stock

2. In general, investments that are riskier tend to provide higher returns over time than investments with less risk.

- ☐ True
- ☐ False

3. In general, if interest rates go down, then bond prices:

- ☐ Go down
- ☐ Go up
- ☐ Are not affected

4. You invest $500 to buy $1000 worth of stock on margin. The value of the stock drops by 50%. You sell it. Approximately how much of your original $500 investment are you left with in the end?

- ☐ $500
- ☐ $250
- ☐ $0

5. If you buy a company's bond:

- ☐ You own a part of the company
- ☐ You have lent money to the company
- ☐ You are liable for the company's debts
- ☐ You can vote on shareholder resolutions

6. Assuming that today a real estate property is worth 100K. Next year there are three possible states of the world:

Recession (at 25% probability): brings the value of the house to 75K
Stagnant economy (at 60% probability): keeps constant the value of the house
Growing economy (at 15% probability): the value of the property will rise to 120K
What would be the fair price of the house today?

- More than 100K
- Exactly 100k
- Less than 100K

7. Assuming you want to buy a property for the long period (no selling expected in the short term). The expected income generated by that property is 12K per year and its related expenses (including taxes) are about 2K per year. If your opportunity cost for alternative investment is 6% and the house value is expected to grow about 1% per year, how much would you be willing to pay the house?

- About 200K
- About 500k
- About 700K
- About 900K

8. By what is the senior mortgage loan secured in a real estate transaction? (check all that apply)

- Equity
- The land and physical improvements
- The mezzanine loan
- The property's cash flow

9. A real estate property is typically valued on the following bases (check all that apply)

- Discounted cash flow
- Non-discounted cash flow
- Capitalization of net operating income
- Comparing to recent sales of similar properties

10. Why would a property investor use debt in a real estate transaction? (check all that apply)

- To increase their return on equity
- To remove risk from the transaction cash flows to equity
- To keep equity capital available for other transactions

3.3 Second nudge: exploiting the psychology of availability

The second nudge that I designed exploits the psychology of availability. This phenomenon affects people impressions of the frequency of an event when they are asked to list a specified number of examples[20]. For instance, in an experiment conducted by the psychologist Norbert Schwarz in the early 1990s, people were asked to list six examples in which they behaved assertively. Then, they were asked to evaluate how assertive they were. Another group of people was asked to list twelve examples in which they behaved assertively, and then they also were asked to evaluate how assertive they were. People who were asked to list twelve instances rated themselves less assertive than people that were asked to list only six examples. Furthermore, when people were asked to enumerate twelve situations in which they had not behaved assertively, they rated themselves as quite assertive. This experiment demonstrated that the task of enumerating examples may enhance the judgment of the trait by two different routes: the number of instances retrieved and the ease with which they come to mind. In the experiment, when participants were asked to list twelve examples, the two determinants are in contrast. On one hand, the participant has just retrieved a high number of scenarios in which he\she was assertive. On the other, while the first two or three instances of assertiveness were easy to retrieve, the participant most likely struggled to think about the last few to complete the set of twelve[21]. The effect that prevailed, as demonstrated by the above mentioned experiment, was the ease of retrieval: participants that were asked to list twelve examples rated themselves less assertive than those who were asked to enumerate only six. This results suggest that the participants make an inference: "If I am having so much more trouble than expected coming up with instances of my assertiveness, then I can't be very assertive" (Kahneman 2011).

In this inference, there is also the role of surprise: fluency is worse than expected, the ability of thinking about new examples decreases faster than expected. "The availability heuristic that the subject applies is better described as an "unexplained

[20] Schwarz, N., Bless, H., Strack, F., Simons, A. (1991) Ease of Retrieval as Information: Another Look at the Availability Heuristic". Journal of Personality and Social Psychology Vol. 61, No. 2,195-20

21 Kahneman, D. (2011) "Thinking Fast and Slow"

unavailability" heuristic"[22] (Kahneman 2011). In fact, the role of surprise is fundamental for the effect of ease of retrieval to happen. In another experiment, Schwarz and his colleagues, tried to eliminate the heuristic by giving the participants explanation for the fluency of retrieval that they experienced. They told the subjects that while they were completing the task of listing examples, music would have been played. One group was told that the music would have negatively affected their ability to retrieve the instances asked for, while another group was told that the music would have helped them to concentrate better and that it would have been easier to retrieve the examples asked for. As Schwarz predicted, subjects whose experience of fluency was explained did not use it as a heuristic. The participants who were told that the music would have made the task more difficult rated themselves as assertive when they were asked to list six as when they were asked to list twelve examples. Therefore, when the effect of surprise is eliminated and when the experience of fluency is given a spurious explanation, the ease of retrieval does not affect people's judgment anymore. In conclusion, the ease of retrieval is a System 1 heuristic, which is replaced by a focus on content when System 2 is more engaged. People that let themselves be guided by System 1 are more susceptible to availability biases than those who "uses more" System 2.[23]

Thus, in order to create a nudge that would decrease overconfidence in private investors, I exploited the fact that people tend to be less confident in a choice when they are asked to provide for many arguments to support it. Furthermore, people are affected more by the ease of retrieval than by the content that they retrieve when they are novices on the topic of the task in contrast to true experts[24]. The nudge takes the form of an anonymous questionnaire where private investors will be asked either to list six reasons why their investment could be a risky one or to list twelve reasons why their investment is a sound one. I also will ask to both groups to rate how good they think their investment is. In this way, I expect that people will have

[22] The availability heuristic as defined by Kahneman and Tversky is the phenomenon by that people judge the size of categories by the ease with which instances come to mind.

[23] Kahneman describes mental life by the metaphor of two agents: System 1 and System 2. Respectively they produce fast and slow thinking. System 1 is fast, unconscious, error prone, automatic and intuitive. System two is slow, conscious, effortful, reliable, analytical and it is where reason dominates. Biases can be overcome when System 2 "takes over" System 1.

[24] Ofira, C., Raghubirb, P., Brosha, G., Monroec, K. B., Heiman, A. (2008) "Memory-Based Store Price Judgments: The Role of Knowledge and Shopping Experience". Journal of Retailing 84 (4, 2008) 414–423

difficulties to enumerate twelve good reasons to invest, because usually it is easier to retrieve less reasons for every choice, and therefore that they will think that their investment is not as sound as they thought it was. On the other hand, I expect that it will be fairly easy to enumerate six reasons why an investment could be risky. This is also particularly true when markets are suspected to be in a financial bubble because media often talk about possible downfalls of investments in these markets.

Therefore, I expect that after being exposed to this nudge, people will be less confident in their investments and will be disincentivized from investing, or will invest less in a market that is so unpredictable as financial bubble ones. In this way, if there are less investments in markets where there is the suspect of a speculative bubble, the propagation of the bubble will be lower.

In the next page it is shown how the two versions of the questionnaire would look like.

Version 1

1) Can you list six reasons why your investment could be a risky one?

1. ____

2. ____

3. ____

4. ____

5. ____

6. ____

2) How sound do you think your investment is?

- ☐ Too risky
- ☐ Risky
- ☐ Fairly sound
- ☐ Very sound
- ☐ I prefer not to disclose this information

Version 2

1) Can you list twelve reasons why your investment is a sound one?

1. ____

2. ____

3. ____

4. ____

5. ____

6. ____

7. ____

8. ____

9. ____

10. ____

11. ____

12. ____

2) How sound do you think your investment is?

- ☐ Too risky
- ☐ Risky
- ☐ Fairly sound
- ☐ Very sound
- ☐ I prefer not to disclose this information

4.Nudge Implementation

In this section I will present how the nudges would be implemented. In section five I will show the design of the randomized control trial, and in section six I will analyze the strength and weakness of the nudges and their implementation.

The most efficient and effective way to implement the two nudges that I designed is through banks that are located in markets where there is the suspect of a speculative financial bubble. In fact, I assume that most private investors will apply for a mortgage when they decide to invest in the real estate market. Therefore, banks will be the institution through which I will deliver the nudges to private investors.

The process would be the following: when a private investor goes to a meeting with a mortgage specialist at the bank to get informed about mortgages, I would ask the bank to deliver to the subject one of the two nudges during the appointment. More precisely, I would like the mortgage specialists to ask the clients if they want to participate in a survey during the meeting. If they accept, the employee of the bank would open the page of the survey and let the client answer the questions. I would also ask to the bank to keep record of each private investor that participated to an information meeting about mortgages and which of the nudge he/she received. In this way, it would be possible to know exactly which private investors decided to apply for the mortgage or not. Therefore, the number of mortgages to which private investors apply for will be used as the metric of the good functioning of the designed nudges. In fact, I would expect the number of mortgages to decrease after the nudges implementation as their aim is to disincentivize investments in the real estate market where there is the suspect of a speculative bubble.

The challenge of using banks, as the institution through which deliver the designed nudges, is that one of the sources of income of banks are mortgages. Thus, in some cases they would not be interested in delivering the nudges. Therefore, I had to narrow the population of banks to those that have the following characteristics: banks that are willing to lower their mortgage position and that are willing to offer alternative financial services, like for examples bonds, government bonds, stocks, treasury bills, REIT[25], etc. In this way, if the nudge works, and investors decide not to invest in the real estate market, banks can propose alternative investments to them and earn revenues from fees and commissions, while clients can still invest in other financial assets that are not at bubble risk. The main assumption here, is that for some banks it may actually be more profitable to diversify their revenue stream, especially when one main source of income are mortgages in markets that might be at risk of a speculative bubble. On that note, my purpose of disincentivize those loans that may put at risk the economic stability is aligned with the banks' one to maximize their profits. In order to find these banks, I firstly selected banks in those markets where there is the suspect of a real estate speculative bubble. To find these markets I used the UBS Global Real Estate Bubble Index[26] that traces the fundamental valuation of housing markets, the valuation of cities in relation to their country and economic distortion. Tracking current values, the index uses the following risk-based market classification:

- "At bubble risk" (score >1.5).
- "Overvalued" (score between 0.5 and 1.5).
- "Fair-valued" (score between –0.5 and 0.5).
- "Undervalued" (score between –1.5 and –0.5).
- "Depressed" (score below -1.5).

The classification is aligned with historical bubble episodes. The index score is a weighted average of the following five standardized city sub-indices: price-to-income and price-to-rent (fundamental valuation), change in mortgage-to-GDP-ratio (economic distortion) and relative price city-to-country indicator. Here, "Bubble risk" refers to the prevalence of a high risk of a large price correction[27]. For the purpose of my research, I selected banks only from those markets labeled as "At bubble risk"

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[25] "A Real Estate Investment Trust (REIT) is a company that owns, operates or finances income-producing real estate". From Investopedia.

[26] Holzhey, M., Skoczek, M., Woloshin, J. (2017). UBS Global Real Estate Bubble Index. Chief Investment Office Americas, WM. Retrived from: https://www.ubs.com/content/dam/WealthManagementAmericas/cio-impact/cio-americas-wealth-management-ubs-global-real-estate-bubble-index.pdf

[27] This is the calculation of the UBS Global Real Estate Index as defined by UBS: https://www.ubs.com/content/dam/WealthManagementAmericas/cio-impact/cio-americas-wealth-management-ubs-global-real-estate-bubble-index.pdf

which are: Toronto, Stockholm, Vancouver, Sydney, London, Hong Kong and Amsterdam.

Toronto (score of 2.12): here, the price growth accelerated in 2016 and reached an extreme 20% year on year in the last quarter of 2017. Real prices have doubled in the last 13 years, while real rents have increased by only 5% and real income has increased by less than 10%. The average number of years a skilled labor worker needs to work in order to afford a $60m^2$ flat near the city center of Toronto doubled from 2007 from four years to eight years. Furthermore, the continuing strengthening of the Canadian dollar and increase in interest rate are strong signs of overvaluation.

Stockholm (score of 2.01): here, in the last 10 years, real prices have increased by 60%, more than twice as fast as income, due to favorable financing conditions. Price growth increased by 5% in 2016, this is below the national average but market imbalances keep increasing. The average number of years a skilled labor worker needs to work in order to afford a $60m^2$ flat near the city center of Stockholm increased from 5 years in 2007 to 8 years in 2017. Furthermore, the rising mortgage debt and building investments confirm the suspect of overvaluation signals.

Vancouver (score of 1.80): here, the price growth peaked in the middle of 2016 when real prices increased to 25% year on year. The average number of years a skilled labor worker needs to work in order to afford a $60m^2$ flat near the city center of Vancouver increased from 6 years in 2007 to 11 years in 2017. In the second quarter of 2017, the growth slowed to 7%, falling below the country average. Income and rental growth were 3% and 5% year on year respectively. Thus, valuations were slightly diminished in last quarters, but the market remains in the bubble-risk zone, nurturing substantial downside and elevated correction risk.

Sydney (score of 1.80): here, the real price increased again to 12% during 2016 and in 2017 were 60% higher than in 2012. Incomes increased by 2% in inflation adjustment terms. Tax breaks and interest-only loans are concealing the affordability of properties. The average number of years a skilled labor worker needs to work in order to afford a $60m^2$ flat near the city center of Sydney increased from 5 years in 2007 to 10 years in 2017.

London (score of 1.77): here, real housing prices are almost 45% higher than 2012 and 15% higher than before the financial crisis. Inflation-adjusted income remains 10% lower than in 2017. Mortgage rates have never been so low, but housing remains quite unaffordable in London: The average number of years a skilled labor worker needs to work in order to afford a 60m^2 flat near the city center of London increased from 8 years in 2007 to 12 years in 2017. However, the rise in property price, has been diminishing since the "Brexit" referendum held in June 2016.

Hong Kong (score of 1.74): here, the residential market prices peaked the second quarter of 2017, reaching an all-time high. Especially prices of small properties increased significantly in 2017, they are three times higher than in 2013 having increased at an average annual growth rate of 10%. Over the same period, incomes remained unchanged, while real rent rose by 3%. Real income has virtually stagnated in the city for many years. Housing is less affordable in Hong Kong than in any other city considered by UBS analysis. Housing prices keep growing because of the appeal of the residential market to foreign and local investors driven by the positive sentiment and the "fear of missing out". The average number of years a skilled labor worker needs to work in order to afford a 60m^2 flat near the city center of Hong Kong increased from 11 years in 2007 to 20 years in 2017.

Amsterdam (score of 1.59): here, from 2015 to 2017 real prices have increased by 30%. The average number of years a skilled labor worker needs to work in order to afford a 60m^2 flat near the city center of Amsterdam increased from 7 years in 2007 to 10 years in 2017. Amsterdam's housing market has strongly departed from the weak countrywide housing market. Income and rental growth have kept increasing with price growth since 2008, limiting the downside risk[28].

Among the banks in these cities, I have then reduced my population by selecting only those that offer both mortgages and alternative investments to clients. In order to do this, I followed a two-step analysis. First, I analyzed each bank income statement focusing on the revenues (what percentage of revenues was coming from fees and

[28] Holzhey, M., Skoczek, M., Woloshin, J. (2017). UBS Global Real Estate Bubble Index. Chief Investment Office Americas, WM. Retrived from: https://www.ubs.com/content/dam/WealthManagementAmericas/cio-impact/cio-americas-wealth-management-ubs-global-real-estate-bubble-index.pdf

what percentage was coming from interest margin). The bank to which I can deliver the nudges are those banks where revenues[29] do not only come from fees (that would be a bank that only offers services) or interest margin (that would be a bank that only offers mortgages) but a mix of the two. Thus, I kept those banks whose fees on revenues and interest on revenues were between 35% and 65%. Secondly, in order to confirm my results, I have also run an analysis on the balance sheets of the banks that passed the first screening. In a similar way to the first point, the key assumption of this analysis is that a bank is willing to "move" part of its revenues from mortgages to other investment only if they actually have other investment opportunities aside from loans. In this sense, I have selected those banks whose mortgage position (mortgages on total assets) was lower than 70%. Using this method, I found seventeen banks in Toronto, eleven banks in Stockholm, nine banks in Vancouver, fifteen banks in Sydney, twenty-four banks in London, nineteen banks in Hong Kong, and nine banks in Amsterdam.

In Table 1, are listed the names of the banks that satisfy the above mentioned criteria and to which I would therefore propose to implement the nudges.

[29] Revenues were calculated as the sum of total interest received, fee and commission income and total net trading income and fair value gains and losses.

Table 1

	Toronto	Stockholm	Vancouver	Sydney	London	Hong Kong	Amsterdam
1	Barclays Bank Plc	Barclays Bank Plc	Bank Of America	Bank of Beirut	ABC International Bank Plc	Barclays Bank Plc	Barclays Bank Plc
2	BNP Paribas	BNP Paribas	BNP Paribas	BNP Paribas	Bank of Beirut	BNP Paribas	BNP Paribas
3	Central 1 Credit Union	Citco Bank	Central 1 Credit Union	China Construction Bank	Barclays Bank Plc	China Construction Bank	Citco Bank
4	Citco Bank	Credit Suisse	Credit Union Central	Citco Bnk	BNP Paribas	Citco Bank	Credit Suisse
5	Citibank	Deutsche Bank	J. P. Morgan Chase Bank	Citibank	China Construction Bank Limited	Citi Bank	Deutsche Bank
6	Comerica Bank	Klarna Bank AB	President's Choice Bank	Credit Suisse	Citco Bank	Credit Suisse	Klarna Bank
7	Credit Suisse	Länsförsäkringar AB	Royal Bank of Canada	Credit Union Central	Citibank	Credit Union Central	Royal Bank of Scotland
8	Credit Union Central of Canada	Morgan Stanley Bank International	TD Bank	Deutsche Bank	Credit Suisse	Deutsche Bank	Sumitomo Mitsui Banking Corporation
9	Deutsche Bank	Nordea Bank AB	UBS Bank	FSA Group Limited	Credit Union Central	Guotai Junan International Hold	UBS Bank
10	J.P. Morgan Chase Bank	Skandinaviska Enskilda Banken		Morgan Stanley Bank International	Deutsche Bank	J. P. Morgan Chase Bank	
11	Morgan Stanley Bank International	UBS Bank		Royal Bank of Canada	Investec Bank Plc	Mason Financial Holdings Limited	
12	President's Choice Bank			Shinhan Asia Limited	J. P. Morgan Chase Bank	Morgan Stanley Bank International	
13	Royal Bank of Canada			Sumitomo Mitsui Banking Corporation	Klarna Bank	Shinhan Asia Limited	
14	Shinhan Asia Limited			The Royal Bank of Scotland	Morgan Stanley Bank International	Skandinaviska Enskilda Banken	
15	TD Bank			UBS Bank	Nordea Bank	South China Financial Holdings	
16	The Royal Bank of Scotland				Royal Bank of Canada	TD Bank	
17	UBS Bank				S outh China Financial Holdings Limited	The Royal Bank of Scotland	
18					Shinhan Asia Limited	UBS Bank	
19					Skandinaviska Enskilda Banken	VTB Capital Plc	
20					Sumitomo Mitsui Banking Corporation		
21					TD Bank		
22					The Royal Bank of Scotland		
23					UBS Bank		
24					VTB Capital Plc		

5.Experimental Design

The randomized control trial would be divided into two parts: a pre-trial period lasting one year and a trial period of the same length. A similar experimental setting was used by Gavert and Kurz (2017) when they tested the effect of a frame applied to restaurant menus to boost vegetarian dishes consumption. One year is the appropriate amount of time for the pre-trial and trial period because the process of getting information about mortgages and the decision about buying a property requires quite some time. Furthermore, in this way it will also be controlled for eventual seasonal effects. I decided to implement the same pre-trial and a trial period of Gavert and Kurz (2017), in order to have time to collect accurate data regarding mortgage subscriptions and private investors' habits.

During the pre-trial period, I wish to gather statistics regarding how many investors that start to get informed about mortgages through banks will actually decide to apply for one. This number will then be compared with the number of mortgages to which private investors actually apply to during the trial period. As previously mentioned, I will use the change in the number of mortgages to which investors decide to apply as a proxy of the good functioning of the designed nudges. In fact, I expect the number of mortgages to decrease after the nudges implementation.

During the trial period, I would ask the above mentioned banks to randomly assign their clients (who are getting informed about mortgages) in two groups, the control group and the treatment group. Then, I would ask each bank to deliver to half of the treatment group the nudge that exploits social comparison. The remaining half should then be divided into two subgroups in order to deliver to one of them the first version of the nudge that exploits the psychology of availability (list 12 reasons why the investment is sound) and to the other the second version of this nudge (list 6 reasons why the investment is risky).

At least 388 subjects should be assigned to each of the three treatment groups and the control group and therefore the randomized control trial will require a total population of 1552 individuals per bank. I think that the pre-trial and trial length of one year is the appropriate amount of time to collect such data. The size of the control and treatment groups was calculated in the following way:

$\mathrm{p}' - \mathrm{z}\sqrt{\frac{\mathrm{p}'(1-\mathrm{p}')}{\mathrm{n}'}} < \mathrm{p} < \mathrm{p}' + \mathrm{z}\sqrt{\frac{\mathrm{p}'(1-\mathrm{p}')}{\mathrm{n}'}}$ where z = 1.96, the error margin is 0.05 and p'=0.5[30]

Therefore: $1.96\sqrt{\frac{0.5\ .0.5}{\mathrm{n}+4}} \leq 0.05$

$$\mathrm{n} \geq \left(\frac{1.96\ x\ 0.5}{0.05}\right)^2 - 4$$

$$\mathrm{n} \geq 388$$

As far as the step of randomization is concerned, some papers suggest to construct a balance statistic in order to check whether the treatment and control groups are balanced in their composition[31]; if this is not the case, an algorithm would reallocate investors among treatment and control groups to increase the balance statistic. During the pre-trial period, I would collect data about the number of clients that applied for a mortgage after the information meeting and thereby obtaining the "Pre-trial Mortgage Applications Quantity". During the intervention period, I would repeat the same procedure as above, thereby getting at the end the "Trial Mortgage Applications Quantity" both for the trial and control group. Afterwards, I would compare the "Trial Mortgage Applications Quantity" of the treatment and control group to check whether their difference is statistically significant during the intervention period. I expect no significant change between the control group quantity of the pre-trial period and the one of the intervention period because subjects belonging to the control group would not receive the nudges. This experimental design, allows to test which of the nudges has more effectiveness. Furthermore, thanks to the control group it is not needed to control for economic fundamentals, clients distribution and financial factors[32] .

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[30] z= 1.96 is the percentile in the normal distribution which cover 95% of the probability distribution.
$\mathrm{p}' = 50\%$ maximize the expression $\mathrm{p}'\ (1-\mathrm{p}')$ and therefore gives an overestimate of the total number of people required for the experiment. Being p' unknown, it is worth having a prudent approach to be sure to have statistical significant results.

[31] Fryer Jr., Roland G., et al. (2012) 'Enhancing the efficacy of teacher incentives through loss aversion: A field experiment'. National Bureau of Economic Research.

[32] Having a control groups helps to keep track of private investors habits and, on the same note, randomly assigning all clients of a bank to the four groups (control and trial) it allows to not control for bank's structural

6. A critical analysis of the nudges

In this section I will analyze the strengths and weaknesses of the nudges that I designed and their implementation.

The main weakness is that the proposed nudges can be delivered only through a reduced sample of banks since their goal is not aligned with the business of all banks. This means that fewer private investors will be nudged and consequently the overall effect for the specific market might be smaller. Nevertheless, I think that this is a good starting point for further research on developing nudges that aim at disincentivize certain types of investments. In fact, since the only way to reduce the creation and propagation of speculative financial bubbles in the real estate market is reducing the volume of capital invested, and therefore in this case reducing the number of mortgages, this will always be in contrast with some banks' interest. A possible solution to align incentives could be to find an alternative method or alternative institutions through which deliver the nudges to a higher number of private investors. However, most investors consider applying for a loan when buying a house. In this context, banks are a key institution with which investors have a relationship. This offers a good metric through which measure the effectiveness of the nudge. Therefore, there is a tradeoff between the number of subjects nudged and the precision of the measure used to check the good functioning of the nudges. The main strength of the randomize control trial is using the number of mortgages as the proxy of the effectiveness of the nudges because deciding to apply for a mortgage is a direct consequence of deciding to invest.

Another drawback is that the randomized control trial, between the pre-trial and the trial period, will last two years which is very time consuming. However, the decision to buy a house and to apply for a mortgage can take a long time. It is also important to consider the slowness of the bureaucracy that can sometimes prolong these processes. Furthermore, the sample of each of the three treatment groups and control group require 388 subjects each for a total of 1552 subjects per bank. Since

characteristics. More specifically, some banks may have a mortgage conversion rate higher than others and therefore if our distribution is not homogeneous this control would be needed.

statistics on the actual number of customers that get informed about mortgages each month will be available only after the pre-trial period, as they are not publicly disclosed by the banks, I think that two years is the appropriate time for the randomized control trial.

On the other side, a very positive aspect of the two nudges is that the cost of implementation is quite low. The overall costs that would be incurred when implementing the nudges are the following: creating the digital questionnaires, negotiating with each bank to deliver the nudges, implementing the randomized control trial and analyzing the data collected during the trial.

Creating the digital questionnaires should be quite cheap since there are free tools that allow to design simple surveys similar to the two proposed nudges. Therefore, the only cost would be the salary of the person that will create the questionnaires. This kind of work could be done in one day (8 hours of labor).

The highest expense forecasted is convincing the banks to deliver the nudges. In fact, this step of the implementation would require multiple high skilled employees that would have to negotiate with the bank directors. Implementing this nudge globally would then translate in negotiations with about 104 bank directors. This process could be very time consuming and could require multiple meetings. Therefore, a week could be the appropriate duration of this step. Considering 8 hours per day of labor time and 5 working days to negotiate with banks, would amount to 40 hours per bank.

The cost of implementing the randomized control trial would be quite low because it only requires a computer which bank's employees already have. The important cost to be considered in this step is the salary of high skilled employees that would have to instruct the bank's personnel on how to deliver the nudges to their clients. I forecast that this step could be done in maximum two days (about 16 hours per bank). Considering the average hourly salary of the selected cities (€ 22.20), the cost of this step is of about € 178.

Lastly, it is fundamental to consider the cost of analyzing the data after the randomized control trial. I would expect this process to take no more than a week. Therefore, the total hours of labor would amount to 40 hours. Considering the average hourly salary of the selected cities (€ 22.20), the cost of this step is of about € 888.

In order to calculate the total cost of labor, I applied the average hourly wage of each country time the hours of labor in that city. Therefore, the total cost of the nudge implementation would be on average €19.4K per each city[33]. The average hourly wages per city expressed in euros can be found in table 2[34].

Table 2

City	Banks	Banks meetings (Hours)	Exp. Design (Hours)	Average Wage (Hourly)	Cost per city
Toronto	17	40	16	16.00 €	15,232 €
Stockholm	11	40	16	25.80 €	15,893 €
Vancouver	9	40	16	16.00 €	8,064 €
Sydney	15	40	16	24.91 €	20,924 €
London	24	40	16	21.30 €	28,627 €
Hong Kong	19	40	16	25.00 €	26,600 €
Amsterdam	9	40	16	26.40 €	13,306 €
			Average	22.20 €	18,378 €
			Online Survery		178 €
			Analyze Data		888 €
			Average Cost per City		**19,444 €**

Another positive aspect of the proposed nudges, is that both questionnaires do not require more than five minutes to be completed. Therefore, I expect a high participation rate in the experiment which is fundamental in order to have causal inference.

[33] I applied the average hourly wage to the common implementation costs (the creation of the digital questionnaires and the data analysis)

[34] The average hourly wages for Europe were retrieved from the Eurostat website: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00173&plugin=1
The average hourly wage for Canada from: https://tradingeconomics.com/canada/wages
The average hourly wage from Hong Kong from: https://tradingeconomics.com/hong-kong/minimum-wages
The average hourly wage for Australia from: https://www.businessinsider.com.au/average-australian-weekly-pay-2018-2

7. Conclusions

This work proposes a way to reduce the creation and propagation of speculative financial bubbles in real estate markets and, by doing that, to contain the damages that an eventual bubble burst causes.

It is proposed the use of two nudges, that exploit social comparison and the psychology of availability, in order to reduce private investors' overconfidence and their biases towards neglecting risk. The two nudges take the form of a questionnaire delivered to private investors through banks in cities considered at bubble risk.

On one hand, social comparison is used by asking individuals to take a test about the financial and real estate markets and then by letting them compare their scores with the median result of people who undertook the test. In this way, the less informed individuals who are about to purchase a home will start doubting their ability in judging the market they are about to enter and therefore will gather more information.

On the other hand, the psychology of availability is used by asking participants to enumerate either 12 reasons to invest or 6 reasons not to invest. In theory, the majority of people should easily be able to recall a low number of reasons while they should struggle to recall a high number. On average, therefore, people will have clearer in their mind that the investment can be risky and not as sound as they believed it to be.

These nudges are delivered through leveraging the banking system. Theoretically, it can be argued that banks may not have the right incentives in diminishing the number of their mortgages as they are one revenue source. However, as explained above, under certain circumstances it may actually be more convenient for a bank to reduce their mortgage position in favor of other type of investments. The key assumption is that for some banks (with a wide range of assets/services) it may be more profitable to diversify their revenue stream. This is particularly reasonable when one of the main source of income are mortgages in markets that might be at risk of a financial bubble. Therefore, I have selected only those banks that, as they are able to offer alternative investments, may be willing to lower incentives for mortgages and increasing their revenue stream coming from alternative financial services. In this way, the aim of the nudge and the interests of the banks are aligned. Banks with several investment opportunities have been selected by analyzing their balance sheet and income statement. More specifically the selected banks are those which have fees on revenues and interest on revenues were between 35% and 65% and whose mortgage position (mortgages on total assets) was lower than 70%.

The experimental design would be organized in the following way: there would be a pre-trial period lasting one year in order to gather statistics about investors and then a trial period of the same length. During the trial period, investors that go to banks to get information about mortgages would be randomly assigned to either the control group or one of the three treatment groups. The first treatment group would receive the nudge that exploit social comparison, the second treatment group the first version of the nudge that exploits the psychology of availability (list 12 reasons why their investment is sound) and the third treatment group the second version of the nudge that exploits the psychology of availability (list 6 reasons why their investment is risky). In order to have causal inference, the minimum number of subjects needed in each group is 388. Thanks to this experimental design it would be possible to test which nudge has more effectiveness.

The cities examined in this work are: Toronto, Vancouver, Hong Kong, Sydney, Amsterdam, London and Stockholm.

If these nudges had a positive outcome, in theory they should be able to protect the weakest individuals (the less informed who just follow the crowed) from investing. This should result both in a reduction of the volume of capital in overvalued real estate markets (therefore reducing the potential crisis) but, more importantly, they should be able to save small families from financial speculation and better preserve them during the recession that follows the bubble burst.

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